

TO: MISR Science Team Oct. 1, 1999

FROM: Mark Helmlinger
MISR Calibration / Validation Team
TELEPHONE: (818) 354-0547
FAX: (818) 393-4619
INTERNET: mch@jord.jpl.nasa.gov

SUBJECT: Trip Report (South Africa, Botswana,
Namibia)

I visited southern Africa from July 24 - August 7 as part of preparatory work leading up to MISR's participation in the Southern Africa Regional Science Initiative 2000 (SAFARI 2000). See Appendix A for more information about SAFARI 2000 via various URL's. Appendix A also contains other explanatory information regarding MISR and its involvement in SAFARI 2000 as well as particulars of my on-site journal communications back to JPL. The body of this report is a day-by-day chronology of my trip, with pertinent journal entries included. Input from readers is welcome, particularly in regards to getting the details straight.

Executive Summary:

Originally a grass-roots effort spurred on by the vision and hard work of Dr. Bob Swap of the University of Virginia, SAFARI 2000 is shaping up to be (from MISR's point of view) the first Earth Observation System (EOS) regional aerosol validation campaign. The experiment continues to evolve, and as it grows in critical mass, other non-NASA US and African agencies are coming on-line with funding and sponsorship. Unlike previous Intensive Field Campaigns (IFC's), (like FIFE or BOREAS), an overall top-down design does not exist quite yet. SAFARI 2000 is a Bring-Your-Own-Budget effort, and those coming to the table bring what they can do, rather than exactly what is needed for a comprehensive and coordinated approach to collecting the kind of field data most valuable to modelers. However, gaps have been identified at the various workshops, and are being filled with specific requests for participation. In other words, it's shaping up. See the SAFARI 2000 website, <http://safari.gecp.virginia.edu> for up-to-date details.

The purpose of my trip was twofold: Represent the interests of MISR at the recent SAFARI 2000 workshop in Gaborone, Botswana, and reconnoiter possible experiment sites for MISR's contribution to the effort. Our intention from the outset was to decide on a central site for

calibration and validation of AirMISR and MISR, and then allow those two platforms to gallivant around Africa to various other sites of scientific interest, rather than having the ground truth team chase about the subcontinent under the ER-2 aircraft and Terra satellite. The question to answer at the Gaborone meeting was where our site should be located.

From an AVHRR mosaic of southern Africa with 1km spatial resolution (Conservatively similar to the resolution of Terra instruments, *Figure 1* at end of photo gallery), two dry lakebed sites (salt pans) were identified: Etosha and Magkadigkadi, *Figure 2*. Originally, Magkadigkadi was thought to be the preferable site. I made prior arrangements with a local grad student for guide services. However, events conspired at the workshop to convince me to check out Etosha. The road map of the entire trip, ala *Indiana Jones*, is detailed on an atlas illustration of southern Africa, *Figure 3*.

I arrived early morning 7/24 in Johannesburg and was met at the airport by a family friend who was a great help in picking up the camper rig I was to use and dealing with South African traffic. After spending the night just a street over from Nelson Mandela's compound, I went to the airport to meet up with Bob Swap and company. We all then proceeded to pick up Harold Annegarn, et. al. at Wits University. We caravanned from there to Gaborone, Botswana.

That evening, 7/25, I registered for the SAFARI 2000 meeting. The next week was spent at the meeting. I met the grad student/guide I had made prior arrangements for, and represented MISR's interests to the gathering. During the course of the meeting, I was convinced to visit the Etosha Pan, Namibia, rather than Magkadigkadi, Botswana. Part of my decision was based on seasonal Landsat images of the pan prepared with remarkable foresight by Johan le Roux, remote sensing and GIS officer for the Namibian Ministry of Environment and Tourism. See *Figures 4 & 5*. I made appropriate arrangements based on my change in plans, and had the good luck to hook up with Dr. Frank Eckardt of the University of Botswana, as an expert guide for Namibia.

After the meeting, Dr. Eckardt and I went on a safari of our own, with the goals of surveying Etosha and Magkadigkadi pans. We traveled for two days to reach Etosha from Gaborone, traversing the Trans-Kalahari Highway to the Namibian border then on to Etosha via Windhoek.

At Etosha, I made essential contacts With the Namibian Department of Environment and Tourism, surveyed the site, and began negotiations for our use next year during the Intensive Field Campaign of SAFARI 2000. I was also able to collect a sample of the pan surface from the area we will most likely use next year for reflective spectrographic analysis.

At Etosha, MISR will have to work around and away from the Okondeka watering hole, *Figure 6*, setting up a camp in the dunes near the existing road, to be resupplied daily. The camp will have an electric fence around it. Note the prevalence of predators, as illustrated to scale in *Figure 7*. A Quad bike must be used to cross the dunes of the western shore and used on the pan to save the alkali from deep wheel tracks. A quad bike will also enable us to avoid curious apex life forms, both bipedal and quadrupedal.

Originally we planned to visit both pans, but rebel problems along the Caprivi Strip of Namibia convinced us to visit the Skeleton Coast after Etosha Pan. Along the coast, I was able to identify

possible sites for CIMEL sunphotometer installations as well as possible surface calibration targets. *Figure 8* was prepared by Dr. Eckardt, and shows several of the features we identified, as well as the towns on the coast for purposes of map correlation.

We returned to Gaborone via Windhoek, and Dr. Eckardt gave me a surface sample of Sua (or Sowa) Pan of the Magkadikgadi district (Dr. King, et. al. overflow Ntwetwe Pan, a bit to the west). Dr. Eckardt has since visited Sua Pan with an eye to operations out there and reports a large homogeneous surface and significant infrastructure extant. Plots of both Etosha and Sua Pan surface reflective spectra appear in *Figure 9*. (Both samples are representative of the brightest surfaces available - see notes for Tuesday, 8/3) After a good night's rest, I drove to Johannesburg along the same caravan route to return the "bukkie" and catch my flight home.

The politics and history of the region are complex, and difficult to understand at a glance. Some of the effects, however, are evident from space. *Figure 10* is an old Apollo photo of the Etosha area. Most of Namibia's population lives north of Etosha because it is less arid up there. They support themselves with cattle, which roam about eating all the grass. Further to the north of Etosha an east-west line can be seen from orbit (and is present in the most recent images, as in *Figure 1*). This is the border with Angola. One would conclude that there are not nearly as many people there, since cattle raising is ubiquitous in southern Africa, and the region is even less arid. Seems the decades-long civil war in Angola has taken its toll.

I am grateful for this opportunity of Adventure made possible by Dr. David Diner, Principle Investigator of the MISR project, and all the other folks I work with every day. Thanks, everybody - you know who you are (See *Figure 11*) - and I know where you live!

Lessons Learned are detailed in Appendix B. Generally, however, I learned a great many things which will have an impact on my logistical planning for next year which were neatly summarized by Dr. Eckardt for me while we crossed the Kalahari for a second time:

"You *can* get things done in Africa. You just have to know where to go -- and bring plenty of time with you"

Journal Entries:

7/24 Saturday

I arrived at Johannesburg Int'l Airport 6am, to be met by Ed Robinson, a family friend, for a tour of the town and late lunch at Carnivore. We pick up the "bukkie", a rental 4WD camper. Ed put me up for the night, and gave me much needed advice and assistance. I also made contact with a South African TV news editor, Amina Frense of SABC TV News who asks for contact & an interview with a Safari 2000 representative. I eventually give Harold Annegarn her info.

Satellite E-mail Messages Sent 24 July:

Will get bukkie later, and zip by Soweto. Ed's place @ Houghton Estates:
26 09.172S, 028 02.681E, 1425M, WGS84, 09:17:12UTC, 24JUL99

7/25 Sunday

Ed gets me to the airport to link up with Bob Swap's caravan. I get a passenger and off we go to Wits University to link up with Annegarn, et. al. We manage to find the place by cruising downtown Jo' Burg, and meet with everyone to continue on to Gaborone. I am graced with engaging passengers (Luann Otter and Meeka ???sp TBD), one for each half of the trip, who keep me alert and driving safe. I get an interesting rundown of the local history from Meeka. We arrive Gabs in the evening and check into Cresta Lodge & register for meeting.

Satellite E-mail Messages Sent 25 July:

Zipped thru squalorous ruins of Soweto. Some places looked like the small arid islands Suz & I saw in Grenadines. The place is really going to hell, even in the "better" 'hoods. However, there is hope & economic opportunity.

Picked up bukkie, a vehicle well suited to task. An underpowered but tough little 4x4 truck, it has 2 tents on top, & all camping equip inside. Even has a refer w/own batt. Charges off engine, but will not drain main batt.

7/26 Monday

First day of meeting. Some Pomp & Circumstance, but not too pretentious. Good to see some official interest. I learn that the State Department thinks we are in Africa because Pres. Clinton made promises in Africa the year before. Some of the funding may be a nod in that direction, but S2K is a grass-roots affair. Can't argue with Mega-\$, however.

I also find out that Michael King, Bob Swap, Tim Suttles, Steve Platnick, Harold Annegarn, Hank Shugart, and Gary Shelton went on a recon flight including Etosha and overflight of Magkadigkadi. They were impressed with Etosha, not Magkadigkadi. Steven Platnick gives me Landsat Images of Etosha made by Johan LeRoux, and mentions odd angular reflectance observed at Etosha Pan. I meet Keabile, and he is not quite what I expected, but then in Africa, nothing is. Turns out he has somewhere to go Saturday next week, cutting into bush prep time, and he will not, or cannot, drive.

Satellite E-mail Messages Sent 26 July:

At meeting now. Met Keabile (4 syllables.) Am at Productivity Centre.

24 40.333S, 025 55.581E, 953M, WGS84, 09:42:15UTC, 26JUL99

This Zap 4 edd. Eric, pls add ang@buffalo.co.za to cc alias list. Pls also bring ang up-to-date by sendingn my intro & later journal entries. Thanx!

Please send copies of short messages to me to satellites 2, 9, & 14, as well as 18. I have not been on the air or free to be to catch #18. Botswana so far seems much happier place. However, have had one power outage already.

7/27 Tuesday

Presentations about proposed and funded research are made. I find that most of my work is done during breaks and lunch, when I can freely interact. I make contact with physics prof at UofB that made a presentation about understanding propagation of solar energy through atmosphere, and turn him on to small handheld sunphotos and Darold Ward's program. I learn that Michael, et. al. did not fly over best part of Magkadigkadi Pan and only saw west end of Etosha. I think I may be able to do better, and want to stick with Plan A. Steve Platnick diplomatically continues his dialog with me and finally convinces me. The other research to occur at Etosha is the clincher. I start asking around for travel partners since Keabile will not be useful at Etosha.

Satellite E-mail Messages Sent 27 July:

Found out why everyone gets up early. Hotel has one H2O htr (geezer in local lingo). Cold shower for me this am! Spent 2 much time yakking at breakfast. Am trying to receive msgs, managed to get sat 9 this am, no msgs.

Hello?

Brkfst w/Broda. Sez all necessary nav info on bus avail for real-time cam.run mods and AirMISR self-initialization. ER-2 autopilot rides stratospheric pressure waves to maintain constant mach# by pitch/alt corrections.

So, ER-2 pilot Ken Broda sez flt planning software is commrcly avail. He will ID sources & pass on to wcl. KB is not confident their manual techniques can guarantee sub-pencil width (appx. 1mi) targeting. Winds aloft are random!

Flying at constant mach means ground speed changes. Therefore, as last Konza lines may show, some automation of cam.run parameters is desirable. Broda sez flt planning needs automation if we want better accuracy.

Have met up w/Keabile. Tall chap, will have to get used to his dialect. Folks very nice here. I feel comfortable. However, there is an influenza bug going around Gaborone... Big meeting. There is a significant sci commun here.

There are many scientists here to work with. They are eager to collaborate. I will make no commitments, but will listen & be open to possibilities to bring home for discussion.

May need direction soon. Swap, etal have overflowed pans in light planes. May need to change plans. Am being lobbied to look at Etosha as well as Magkadi. Stay tuned.

Mike King has flown over both Etosha & Magkadi pans as part of a site survey. Also on flight: S.Platnick T.Suttles, G.Shelton. King not at mtg. The rest were not impressed w/ Magkadi. King probably not, either.

King, etal did not fly over Sua Pan. Have hooked up w/Frank Eckardt, the Pan Man of UoB. Showed me aerial photos of Sua, the Eastern pan in the Magkadi region. Looks good, close to salt mine. 40km from tourist camp.

7/28 Wednesday

Break-out groups and my presentation of Jim's transparencies. I am regarded with stunned silence. I later meet Frank Eckardt, and he gives me the lowdown on the way things are in Africa. Food for thought. I begin looking for a road companion in earnest. Kobus finds out I will be heading towards Etosha, lobbies me to deliver two passive aerosol samplers for him - one to Windhoek, one to Etosha. I tentatively agree.

Satellite E-mail Messages Sent 28 July:

So, you could say the Satellite Gods have not been kind. Keabile (KB) has suggested using his E-mail account. Send copies to: tlhalerk@noka.ub.bw Please be keen in the early am, 0800PDT, we may be able to log on at same time.

Have figured out why the other Americans here, (Goddard, Virginia, HQ) are so confident. They do not travel alone! Feel a bit overwhelmed, mostly because have a nagging sense that operations in Africa are exponen'ly difficult...

F. Eckardt, the Pan Man, has volunteered 2 act as travel consultant. Keabile is nice guy, but not sure how to best utilize. Have not made up my mind about who 2 go with, no less where. Lots in air. Now to go pray to sat gods...

Praying to the Satellite Gods... I can sit in meetings and poke at my toy here, and I can duck out sometimes & catch a sat to send to. But, having a day not scheduled around sat overpasses makes downloads tough.

Sat 9 up often today. Will try to poll it for messages for me.
24 40.373S, 025 55.580E, 896M, WGS84, 11:58:49UTC, 27JUL99

I say S2K is a serious effort & worthy of R best effort. S2K NOT drain on R time&eff some hve said, but an (expnsve) opprtnty 2 pursue R science synergistically. S2K may B R only data gathering effort in 2K, but cld B all we need.

Customs, permits, & payoffs are a concern and will be a major factor in site selection. I will research what I can here. Cool thing about mtg in Africa is you talk to Africans about the real deal. Back to boring - oops, meeting.

To: safari2k@jpl.nasa.gov
Subject: [Satellite = Keabile's Computer at UoB]

Wow! More than 200 characters! I mean I am sending from, well you can tell. Anyway, I noticed that the satellite number I transmitted from appears as the subject on the E-mail that I sent out over the orbcomm. That means ignore all my other requests for sending to certain sat numbers. Just send to the number I sent from. It'll pass overhead sometime later. Peruse the satellite #'s and copy to all of those as well. I don't know if just replying to my sat mail will work. Follow instructions at end of my first submission to the SAFARI2K list or website if in doubt.

Also, copy to this address until Friday. Making pan plans still. Gave MISR/AirMISR talk to African researchers. 5 min, Annegarn (meeting leader) was pleased, audience stunned. I am handing out MISR/JPL/NASA propaganda left and right. Swap & co. have clued me into how we are keeping a low profile. Our efforts have orders of magnitude more funding than the local research, and we need to be sensitive to this.

The Orbcomm deal is unlimited messages for a few months, so go wild and send me a message! I want to get something over my toy besides perfunctory updates from Orbcomm.

I ask at the front desk of the Cresta Lodge every evening if there are messages. Urgent stuff can be handled that way. JMR has the numbers. Guess I could call late at night, and just might, but cringe at the charges and the dialing hassle.

The camcorder works fine, now that I figured out how to turn off the flashing time and date. Not much to video in a meeting (zzz). The pomp & circumstance lasted just the first hour and then it was right down to business.

SAFARI 2000 is coming together nicely. The cal/val work we want to do is mentioned as a matter of course, and included in all of the pertinent tables and handouts. They are sold on the idea. I am answering questions and trying to figure out the best pan to visit.

Pan man Frank mentioned a possible itinerary that we will discuss tomorrow. It involves hiring out tourist plane to look at pans as well as walking out onto the pans. No

mountains around and very flat, it is possible to get out in the middle so that entire horizon is pan, like a solid ocean all around you. Surrealistic!

Gotta go. Dinner is being served. Food here healthy but not much to write home about. Losta meats and sauces over rice.

7/29 Thursday

They (other meeting attendees) go on field trips. For me - networking, museum, and shopping downtown with Tim and Steve.

Satellite E-mail Messages Sent 29 July:

OK, have figured out wot 2 do. Went thru itinerary with Pan Man & head of Namib enviro dept. Only time for one pan. MKing (\$\$.source) likes Etosha, so dats it. Besides other good reasons which is why MK liked it. PI's here concur.

So, will not require services of Keabile. Sorry old chap. He took it well. Has things to do anyhow. May have a UW fellow along, depends on things. He has a small Si-only ASD with him...

7/30 Friday

Networking, trying to find someone to go with. Aha - The Pan Man Frank sez he'll go! Intro by Platnick to Botswana Met folks who want to do Magkadigkadi pan. Fella by the name of D.M. Lesolle, Principal Meterorologist, Botswana Met Service. They propose sending a team to work Magkadigkadi with their uncalibrated instruments and my older calibrated ones. I know the GER and a manual sunphotometer can be kitted up for labor-intensive use, so I agree it is a good idea. Kobus gives me many thanks, and two of his instruments. He has a trailer full of 'em. I check out of Cresta and crash at Frank's place.

Satellite E-mail Messages Sent 30 July:

Americans here at the hotel has run up an 11,000 Pula phone bill. At 4.2 Pula/\$, that's still big change. 2 17min calls and 1 54min call. A bit much anywhere. Phone cards will not work. I have not received any msgs.

Equip to drop off at Windhoek... Kobus Pienarr of Potchefstroom Univ found out I am going thru town. He has asked me to deliver 2 passive particle collectors and I have room. One piece goes to Etosha as well. This is Africa...-

sat7/31 provision
sun8/1 dep am Gabs on Trans-Kalahari
arr pm Witvlei "Dollhouse"
mon 8/2 dep am Witvlei
Drop off Equip in Windhoek
arr pm Etosha research station
(contact info to follow)
tue 8/3 to wed 8/4 recon Etosha
(CONT)-

thu 8/5 dep am Etosha
arr pm Witvlei
fri 8/6 dep am Witv
arr pm Gabs
sat 8/7 dep am Gabs
arr early pm Buffalo Campers
Will get ride to airport to dep Jo'burg
0800LT AA flt 6001
pew!
Contacts to follow...-

KB & I will be out of contact. If getting msgs bounced, could be too long. Spaces & returns count.

CONTACTS

Johan Le Roux
Etosha Research Station
jlr@tsu.namib.com
+264-67-229854

Angela Joubert
Buffalo Campers
ang@buffalo.co.za
(+27 11) 704 1300

Send out the dogs if these folks never see me!

Another in-country contact:

Frank Eckardt
Univ of Botswana
(the Pan Man)
Home: 371604 (in Gabs)
Work: 3552540 (needs country code to dial from US)

eckardt@noka.ub.bw

May be able to get spectra of Etosha, as well as overflt. Have calc itinery. About to check in @ US Embassy. S Platnick has great idea of cooperation w/Botsw Met Svcs which enables refl + sunphot from Magkadi AND usual @ Etosha.

Phone calls \$7+/min.

This thing may pay for itself.

24 40.333S, 025 55.555E, 975M, WGS84, 09:05:48UTC, 30JUL99

7/31 Saturday

Day of rest and shopping for me. Frank and I provision for the trip.

Satellite E-mail Messages Sent 31 July:

Frank's pad at: 24 40.518S, 025 51.894E, 989M, WGS84, 08:04:57UTC, 31JUL99

Crashed here last night. He sez use as Base Ops. Cool guy. Will head out tomorrow after handling details.

8/1 Sunday

Day 1 of recon - Trans-Kalahari Highway out of Gabs. We drive from sunup to sundown, no night driving, and camp for the night near Witvlei. I see the Southern Cross, figure out how to estimate the south celestial pole, and look towards center of our Galaxy. Our bukkie proves its worth.

Satellite E-mail Messages Sent 01 August:

Traveling with Pan Man on Trans-Kalahari hwy. Discussing situation here 4 Euros. Sez "Africa is life on the edge; total freedom. If U want, U can be dead by breakfast." He's lecturing geomorphology along way 4 me. Way cool!

Ziping along at about 115 km/hr, w/antenna out the window. Trying to poll every sat that zips by. No luck so far. Current location:

24 33.698S, 024 12.169E, 1153M, WGS84, 07:56:01UTC, 01AUG99

Am camped out w/Frank furthest from home I have ever been. Loving every minute of it. See if U can find us on a map, just N of Witvle:

22 22.187S, 018 29.835E, 1280M, WGS84, 18:25:53UTC, 01AUG99

I have seen the Southern Cross & the center of our Galaxy. A rite of passage, you might say. Also seen satellites and immense clusters of stars. This sky is bereft of city lts & brite w/stars. Can't quite hear them yet...

8/2 Monday

Witvlei to Etosha. We drop off one of Kobus' instruments to (TBD) at Namibian Botanical Society in Windhoek. Arrive Etosha in late afternoon. We drop Johan LeRoux's name at the gate, and the guard jumps to. We make contact with Johan, who makes arrangements for tomorrow.

Satellite E-mail Messages Sent 02 August:

On way to Etosha. 22 03.883S, 021 25.572E, 1244M, WGS84, 12:26:59UTC, 01AUG99
Will make almost Windhoek by tonite. Plan is to eat at Dollhouse (USED to be what it sounds like) and then camp in bush down the road.

In Namibia now. 22 20.415S, 019 22.244E, 1650M, WGS84, 15:13:33UTC, 01AUG99
Approaching Witvlei. Getting drier, cooler. Have seen Secretary bird. & poss stork of some kind. Making good time.

NOTE:

Please copy msgs to me for near future to: jlr@tsu.namib.com

Will pick up msgs when arrive. Thanks Johan!

We R ~150km from Namib border. Pan Man be sez can't believe it - it's getting flatter!

Petrol in Gobabis. Had to add 2L of 30W oil. Seems like a lot. Will try heavier weight if consumption continues. 2L extra oil back of seat. Engine has light ping at 120km/hr w/ out a/c on. Soot on tpire & bumper. No smoke. Rings?

On road to Windhoek pre-dawn. Chkd oil, sooty, black, but full. Will try for oil change in town. Might add STP. No change in engine - smooth, starts & idles well, runs fine - gutless as ever, no smoke. Will chk oil religiously!

Just stopped @ Windhoek airport. Real porcelain. Avis rents 4WD Hilux, has 50 of 'em. Most expensive in world, they loose 4/week to rollovers. Will be extra careful w/ours! Saw baboons on road. Gosh, they run fast...

Tourists go to game parks. Frank calls them petting zoos - here, kitty, kitty... Where we are and where going, we'll be lucky to see big game. Animals hide. Might happen to see some game @ edge of pan where wet.

Dropped off Kobus' passive sampler @ Namib Botanical Society. Did EOS/S2K song & dance. Am out of brochrs, had to spew URL's. Windhoek is a major burg, got Rands for rest of whirlwind pan tour.

Lunch @ German deli in Outjo. My first schnitzel hamburger. Dr. Eckardt has great idea 4 aerogel as deposition media to entrain airborne particles. Penetratn depth indicative, as aerogel can be made in diff densities...

Coming up on Etosha Park. 19 32.808S, 015 52.597E, 1149M, WGS84, 14:55:33UTC, 02AUG99

Tourist camp & research station here. Gotta pay the bills somehow. Asked Johan if remote sens info helped manage park. He said they don't manage, they're awed. Local water hole is floodlighted w/benches 4 viewing. Saw elephant.

Have arrived Etosha & made contact w/Johan. Has impressiv array of maps & imagry @ fingertips. Was able to zoom in on pan using realtime meteosat downlink. 19 10.472S, 015 54.809E, 884M, WGS84, 19:44:17UTC, 02AUG99

8/3 Tuesday

Etosha - Johan and I pour over Landsat images looking for homogeneous areas big enough for MISR. We identify likely areas on either side of Gonob Peninsula. Ned Brain flies me over site. Looks good from air. After flight, Johan tells Frank and I to wait at watering hole where we see all kinds of wildlife. Frank then goes tromping off with Martin, resident geomorphologist. Johan and I drive out to Gonob to take a look at pan. Johan has GPS hooked up to laptop to put a red dot where we are. Too cool. We find pan way too soft and too lumpy.

We then go to west end of pan and find much more ideal situation. Pan surface is hard and consistent over very large area. Much more like playa surfaces of the American west, of which I have seen a few. Our location: 18° 58' 0.9" S 15° 52' 38.2" E. A surface sample is collected.

I observe angular scattering mentioned by Dr. King & Co. and confirm that the BRF of the Pan is similar to what has been observed on our playas back home. Essentially a "hot-spot" effect due to small-scale topography and shadowing, such surfaces appear darker when looking toward the sun than away, which can be counter-intuitive if one expects a specular effect - which *does* happen for smoother surfaces at shallower sun angles. (Sometimes micaceous silt can be included in the clays, adding some spice to the observed BRF.) It is very difficult to reproduce these structure-dominated effects in the laboratory since the surface topography is rarely preserved by casual sample collection. Therefore, the spectra presented in *Figure 9* cannot faithfully represent actual in-situ reflectances, but can serve as a guide to particular spectral features and overall reflectance effects.

Johan and I discuss logistics. I am brought to Wilfred Versfeld, Director of the Etosha Ecological Institute. Johan and I relate the experiment scenario that MISR will propose to. Mr. Versfeld, familiar with SAFARI2000 due to Dr. King's earlier visit, receives my scenario enthusiastically and explains bureaucratic necessities.

I realize later that PARABOLA will require power and that to stand off from the pan with the solar panels a significant distance may be difficult. May have to use uninsulated wires left charged so that they won't get chewed (much) . . .

Satellite E-mail Messages Sent 03 August:

By time you recv this, I will be out of touch w/Johan. Pls. copy msgs to eckardt@noka.ub.bw & I can pick them up when we arr Gabs. Johan sez I have msg from Herb. Hi Herb! Just waking up here, will fly & walk pan today.

Got E-mail from Carol & Susan via Johan's account. Now I know how to meet my daughter @ LAX 8/8. Will confirm details later. Also have answers for Carol, details later. Had helluva day today, details later. Goodnight...

8/4 Wednesday

Etosha to Skeleton Coast. Frank takes us into the Namib past the Brandberg batholith. We traverse across Ugab river, path of Etosha dust, down alluvial fans to coast where salt pans collect. I investigate bright pans & fans of uniform reflectance. We stop at Cape Cross to investigate pan found there. We camp at Mile 72 on beach.

Frank insists on doing the dirt driving, so I have time to compose a few satellite messages . . .

Satellite E-mail Messages Sent 04 August:

Yesterday, Johan & I picked out a likely area on the pan to go check out from '97 dry season Landsat imagery. He has an impressive system using ER Mapper on Pentiums. Also downloads AVHRR data directly from the bird.

So, after deciding what region on the pan looked good, we waited for the compound to be buzzed by our pilot, Ken Brain, the park vet. Didn't have to wait long...
ZZZZOOOOAAUUMMMM!!!

So we head out to the airfield, past the trees & buildings & I begin to get the feel of the place. The only thing on the forward horizon is a large shed & a Cessna 180, just taxiing in. It takes a few km to get there...

After plane ride, waited for Johan at water hole. Got amazing pics + video, 100% better than the zoo! Have seen all big game except rhino & cats. Then Johan & I 4WD out to Gonob, (takes hour+) and find soft pan. No good. Rats!

So after det that the largest homogeneous areas of the pan are soft & grey (& as big as Railroad Valley), It becomes obvious that we are not finished. We decide to go see what Mike King liked about the eastern edge of the pan...

The immensity of Etosha is daunting. The landscape is very arid, & very very flat. You would swear the curvature of the planet is visible, 360deg around you. No Mts on horizon, just you, sticking to the bottom of the World...

Hi Ghobiee! Ya, I hope I can help you w/cal lab once I do my travel expense report and debriefing preps. Knowing U, you'll be done before I get back. Did they paint the room black like I asked?

HI HERB! You have managed to SPAM the constellation. Have recd 15 or so msgs. U R most successful. Congrats to Matt. I heard your sigh of relief down here!

Major change in plans (again). This time real good reason. We were going to try to get to Magkadikgadi via the Caprivi Strip, but the area is under siege by separatist rebels. Welcome to Africa, border is closed, sair.

Operations & logistix would be much simpler if we 'airdrop' into Windhoek. Must look into poss of C-141 stopping & dropping us off. USAF regularly flies C-141's with de-mining equip into Windhoek, so it can be done...

Out of Etosha early am. Bfast @ Outjo. Then on to Khoraxis & 'round Brandberg formation. Most remote region so far...

21 10.386S, 014 21.911E, 557M, WGS84, 14:17:42UTC, 04AUG99

There R gypsum pans up 2 beach here. Huge ones. We will visit Ministry facility tomorrow & make contax 4 poss sunpot site. Maybe Brent could be persuaded 2 put a CIMEL up...

We are camped at: 21 52.425S, 014 04.052E, 36M, WGS84, 18:32:56UTC, 04AUG99
The bakkie camper w/tents on roof is proving to be a tough & practical vehicle. The tents are just perfect & easy to put up. Think we have scored cyl...

8/5 Thursday

Skeleton Coast to Witvlei. On way to breakfast in Henties Bay, we find a new research station being built right on the coast, on dunes overlooking the beach. This may be a good place to site a CIMEL sunphotometer. We get gas and proceed to Swakopmund, where we eat breakfast at a Konditori and load up with goodies for the return to Gabs. Swakopmund is a clean town, with everything we would need for support. We visit the local Ministry of Environment and Tourism, and notice that their building has a nice flag perch where a CIMEL might be placed. We make contact with local Ministry of Enviro & Tourism. We drive back through Windhoek, and on to the Dollhouse in Witvlei, which is open this time through and enjoy a home-cooked dinner.

Satellite E-mail Messages Sent 05 August:

Correction to last given location. Was camped out south of Cape Cross, not point. New UofNamibia research station north of Henties Bay. Possible sunphot location:
22 05.844S, 014 15.690E, 24M, WGS84, 06:43:28UTC, 05AUG99

The search continues for stout German porcelain... Actually, in its essentials, this trip has been no different than a similar trip in the western US. But you're close to the edge - and you can tell...-

This terrain gives new meaning to "bleak". Flat, foggy, no hovels, no poles, nothing but hard salt track and an infinity of coarse alluvial sand... We press on, to Swakopmund for German breakfast.

Jean, please also let Annegarn know that I will telephone from Frank Eckardt's house in Gaborone the eve of Aug 6. Thanx!

Also, msgs to me goto: eckardt@noka.ub.bw We will pick up on arr to Gabs.

8/6 Friday

Witvlei to Gabs. Breakfast at the dollhouse in the pre-dawn hours and then we are off for a relatively uneventful drive across the Kalahari. We do see evidence of game vs. high-speed truck interaction, however. We make it back to Frank's pad.

8/7 Saturday

Gabs to Jo'burg. I say farewell and thanks to Frank. Return rental. Bob Swap and Harold Annegarn debrief me, Bob mentions micropulse lidars may be available for Etosha, now growing into a major site. I depart Jo'Burg that evening. Long flight home.

APPENDIX A - Prequel to Satellite Messages & Relevant Background Information

Subject: Mark's Journal . . .

To: safari2k@jrd.jpl.nasa.gov

Cc: Mark.C.Helmlinger@jpl.nasa.gov (Mark C. Helmlinger)

Howdy all! Welcome to my SAFARI 2000 Journal & Field Report(s)...

All following messages will be much much shorter. Some preliminary stuff for now...

This E-mail was sent to a list of addresses at

SAFARI2K@jrd.jpl.nasa.gov

You can send to that list too. I will be sending my journal entries from my Africa trip (via satellite) to the above address and thereby the list.

You are on this list because you either asked to be, I thought you would be interested, or I think you need to know. The keeper of the list is Eric Danielson at

edd@jpl.nasa.gov

He will add or subtract folks as requested. Thanks Eric!

You will be able to send short E-mail messages to me via the Orbcomm satellite network. Details on how later. Some background for the non-JPLers on the list...

The MISR web site is

<http://www-misr.jpl.nasa.gov>

Interesting factoid: The third largest NASA line item after Space Station and Space Shuttle Ops is the Earth Observation System, of which the MISR Project at JPL is an eensy beensy (precise comparative term) part. Links to EOS & other cool NASA stuff can be found on the MISR page above.

About a year ago, the MISR Science Team was convinced to participate in SAFARI 2000, an international field campaign in southern Africa in 2000. More info about that is at:

<http://safari.gecp.virginia.edu>

I will describe my rough itinerary in order to frame the context of my future journal entries, which will be terse and arcane, for various reasons. The entries must necessarily be short for the sake of the satellite memory buffers, and I will include scientific jargon in order to communicate with my team at JPL.

The experiment is next year, but next week there is a workshop in Gaborone, Botswana to attend. Earlier this year, there was an equivalent workshop held in Boulder, CO. It was a shirtsleeves working meeting hashing out the details. The meeting in Botswana will be that, but after a bit of pomp and circumstance it seems, judging by the ambassadors and dignitaries listed on the agenda. Guess I will have to pack those dress shoes after all.

It may seem at times that you have stumbled into the middle of an ongoing conversation. I will try to include interesting stuff and try to describe my experiences and observations. I am solely responsible for content/opinions implied or expressed, and I will assume a PG-13 audience. Hey, G might be too boring!

Professionally, I have been preparing for a trip such as this from day one at JPL; ever since Dr. Carol Bruegge hired me out as an APT student for fieldwork during the FIFE campaign on the

Konza prairie, Kansas. It was a formative experience for me, to say the least. If you know me, you know of my enthusiasm for the job. Well, trips like this are why.

OK, details...

I am going to the meeting not only to represent the MSIR project, but also to make contacts and arrangements for field research. The meeting lasts a week, and for a week afterwards, I will be bumping about in the bush looking for a suitable site for next year.

I have made arrangements (with a lot of help from our secretary, Jean) for a bakkie 4x4 jeep/camper, and an escort/guide through the University of Botswana.

<http://www.ub.bw>

We will be traveling to the Makgadikgadi Pans looking for a dry lakebed situation similar to what we use here in the States. For an idea of what the region looks like, see:

<http://www.wildlifeafrica.co.za/makgadi.html>

The bakkie was rented from:

<http://www.buffalo.co.za> (Look for the Toyota Hi-Lux)

Further details...

I will be flying nonstop to Johannesburg on a 747, arriving early on the morning of the 24th. I will be met by a family friend, Ed, who lives 3 doors down from Nelson Mandela. Ed is involved with the International Basketball Association, and promises to be an interesting and gracious guide about JoBurg and SoWeTo. He has offered to put me up for the night. I have no doubt that I will have a great time, with him leading the way... Thanks, Ed!

The next morning, I will meet several other meeting attendees (who will be congregating after their respective flights) at the airport in order to caravan to Gaborone. A five-hour drive with some mountain passes, something it is not wise to do at night.

We will all be staying at the Cresta Lodge, (navigate to that from the wildlifeafrica home page) and meeting at an official Government compound all on The Mall in central Gaborone. There will be a formal reception the first night. Oops, left my tux in Kansas...

I will meet up with my escort/guide at the meeting and we will pack/shop/prepare for the bush in the evenings of the meeting. As soon as the meeting splits up, we zip up to Francistown and points beyond. May it be interesting, but not too interesting.

We will be looking for a consistent bright dry lakebed to use in calibrating the EOS borne MISR instrument, and the ER-2 borne AirMISR instrument. They will fly overhead next year while the

MISR cal/val team operates several radiometric instruments on the ground. The usual thing, essentially using tripod-mounted used UFO parts to make sure that the sensors overhead are making good measurements and reporting accurate numbers.

The escort/guide I have been put in contact with:
Keabile Tlhalerwa (Mr.) University of Botswana Department of Environmental Science
Gaborone. BOTSWANA

OK, this is how to send me E-mail in Africa via the satellites... Log onto the website

<http://www.orbcomm.com>

and follow their instructions on how to send a GlobalGram, or, compose a 182 character max message (including spaces and returns). The subject line must be formatted as follows (braces absolutely necessary):

[globalgram:sat=XX]

Where XX is the two digit satellite number. Please use satellite #18 for now. I may send a message requesting otherwise later.

Please be sure to identify yourself in the body of the message. I will not be able to recover the senders E-mail address. I also will only be able to send to the general safari2k list and a few specific JPL addresses, so do not ask a question you do not want everyone to see the answer to.

I will try to send/receive at least once a day.

And so, the adventure begins...

- Mark.

APPENDIX B - Lessons Learned:

Do not travel alone. Make arrangements to be met at destinations. Local guides and contacts are essential. Recruit as much governmental participation and approval as possible, and allow enough time for the wheels of bureaucracy to grind on the paperwork. Find competent in-country personnel who have a personal stake in the successful outcome of your work. Be prepared to compensate them for their interest.

Do not openly display frustration or expect different treatment because of who you think you are. Do not tell the locals how to run their country. Quietly observe sentiments towards the US and behave accordingly. You are a guest.

Minimize driving. Highways are the most lethal places in almost any country. Do not rely on local drivers or their skills. Do not rely on local public services. Carry an International Driving Permit. Drive a massive vehicle with seatbelts. Use them.

Inform the State Department of your plans at a high and official level, early. Do not expect much from them unless political expediency is in your favour. Advise all concerned of negotiated MOU's and other documents pertaining to your work. Carry such documents with you. Have an ally in the local bureaucracy. Carry extra local currency for "administrative fees".

Involve as many people as possible, and inform them tediously of your itinerary. Take pains to explain your goals and needs diplomatically. Sell yourself and your work. Recruit allies. Let folks know where you are and where you can be expected. Keep in touch.

Identify emergency procedures and contacts. Insure yourself to your Total Expected Lifetime Earnings (Mega-bucks). Plan for the worst - ask how your body would find its way home and who would have to pay for it. You won't be caring, but what a hassle for those left behind . . .